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VERIFICATION OF TRANSLATION

I, Michael Wallace Richard Turner, Bachelor of Arts, Chartered Patent Attorney, European Patent Attorney, of 1 Horsefair Mews, Romsey, Hampshire SO51 8JG, England, do hereby declare that I am conversant with the English and German languages and that I am a competent translator thereof;

I verify that the attached English translation is a true and correct translation made by me of the attached specification in the German language of International Application PCT/EP03/06147;

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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Fog projectile

10 The invention concerns a fog projectile having an active charge comprising a pyrotechnic active material for producing an aerosol which emits in the infrared and which is impenetrable in the visual.

Armoured and unarmoured vehicles are protected by means of aerosol curtains from discovery, detection and target tracking and thus from the threat of missiles.

15 DE 199 14 097 A1 describes a suitable pyrotechnic active material for producing an aerosol which is strongly emissive in the infrared and impenetrable in the visible. That active material develops a protective camouflage fog or mist which, besides impenetrability in the visible range, also permits long-duration cover in the infrared range. As its main  
20 constituents that active material contains red phosphorus, an alkali metal nitrate or a mixture of alkali metal nitrates while as secondary constituents it contains at least one transition metal or a metallic compound or alloy thereof, at least one metalloid and a binder.

As the threatening missiles approach at flight speeds of 200 to 600  
25 m/s, a fog screening effect must take place very rapidly, after they have been identified. Known projectiles however deploy their action only after a flight time and time delay of for example 2 s. In that time the vehicle is unprotected.

DE 29 08 217 C2 describes a unit charge for fog concealment of  
30 vehicles, having a casing filled with fog bodies. The fog bodies are in the form of cylindrical flat discs with an open central hole, which are disposed one upon the other. The fog bodies are ejected without an enclosure from the casing. The arrangement does not provide for fading out of the line of sight in the infrared range.

The object of the invention is to provide a fog projectile of a simple structure, which is so designed that rapid fading of the line of sight in the infrared radiation range and in the visual radiation range occurs upon discharge in a spatial angle.

5           According to the invention the foregoing object is attained by the features of claim 1.

          The active charge stack consisting of the hollow-cylinder segments is discharged or expelled, held by an enclosure or sheathing, from a projector barrel, whereby aerodynamic stability is guaranteed in the initial phase of  
10   the flight. That ensures that the stack does not already deploy immediately at the vehicle. It is only after some metres of flight, for example 5 m to 10 m, that the fired hollow-cylinder segments break the enclosure or sheathing open. Due to the resulting absence of aerodynamic cladding the flow of air acting thereon gets into the stack of the hollow-cylinder  
15   segments. As a result the segments are immediately driven apart, which results in the burning hollow-cylinder segments fanning out over a large area, in a wide spatial angle. That provides an aerosol fog or mist distribution very quickly, for example within 0.25 s, which conceals the vehicle both in relation to missiles approaching horizontally and also in  
20   gliding flight, in the infrared radiation range and in the visual radiation range. In the vehicle therefore there is a period of time which is long in comparison with the state of the art to perform travel manoeuvres to evade the moment of impact, as calculated in the vehicle, of the approaching missile.

25           Advantageous configurations are set forth in the appendant claims and the description hereinafter. In the drawing:

          Figure 1 shows a fog projectile with a plurality of layers of hollow-cylinder segments in an enclosure or sheathing,

          Figure 2a is a plan view of a layer of four hollow-cylinder segments,

30           Figure 2b shows a side view in the direction of the arrows IIb-IIb in Figure 2a,

          Figure 3a shows a plan view of a single hollow-cylinder segment,

Figure 3b shows a perspective view of a single hollow-cylinder segment,

Figure 4 shows an apertured disc of the enclosure or sheathing,

Figure 5 shows a foil of the enclosure or sheathing, unwound,

5 Figure 6 shows the fog projectile in a discharge device,

Figure 7 shows an aerosol fog produced by the fog projectile, and

Figure 8 shows a time diagram of the development of the effect of the aerosol fog.

A fog projectile 1 comprises a hollow-cylindrical active charge 2, a  
10 firing charge 3 and an enclosure or sheathing 4 (see Figure 1). The active charge 2 is a stack comprising a plurality of layers 5 of hollow-cylinder segments 6. Each layer 5 is composed of a plurality of hollow-cylinder segments 6. There is a hollow space 7 in the interior of the active charge stack.

15 As shown in Figures 2a and 2b each layer 5 is formed by four hollow-cylinder segments 6, wherein the segment angle  $\alpha$  is  $90^\circ$  and the individual hollow-cylinder segments 6 bear against each other. The segment angle  $\alpha$  can also be smaller than  $90^\circ$ , in which case then there are correspondingly more hollow-cylinder segments 6 in a layer.

20 The diameter  $d$  of the hollow space 7 is  $\leq 1/6 D$ , wherein  $D$  is the outside diameter of the active charge stack (see Figure 1 and Figures 2a and 2b).

The active charge stack 2 is of a height  $H$  which is for example  $\geq 20 h$ , wherein  $h$  is the height of a hollow-cylinder segment (see Figures 1, 2b  
25 and 3b).

The height  $h$  is preferably  $\geq 1/15 D$ .

The hollow-cylinder segments 6 are compressed from a pyrotechnic active material which produces an aerosol which is emitting and damping in the infrared radiation range and which is impenetrable in the visual. An  
30 active material of that kind is described in DE 199 14 097 A1. As main constituents it has red phosphorus, an alkali metal nitrate or a mixture of alkali metal nitrates and as secondary constituents it has at least one

transition metal, or a metal-rich compound or alloy thereof and at least one metalloid and a binder.

The firing charge 3 which serves to fire the hollow-cylinder segments 6 by way of the hollow space 7 and which can serve as a discharge charge is a pyrotechnic firing composition which contains:

50 to 80% by mass of black powder,

0 to 20% of an organic binder,

0 to 20% of a metal powder from the group of the metals magnesium, aluminium, boron, zirconium and titanium, and

0 to 20% of a burning moderator based on a transition metal compound such as  $\text{CuO}$ ,  $\text{K}[\text{Fe}_2(\text{CN})_6]$ ,  $(\text{C}_5\text{H}_5)_2\text{Fe}$ .

The enclosure or sheathing 4 has a combustible foil 8 which for example comprises a paper saturated with paraffin. The foil 8 initially holds together the active charge stack 2 consisting of the hollow-cylinder segments 6. The foil 8 encloses the active charge stack 2 at the top side and at its periphery U, corresponding to the diameter D, over the entire height H. Figure 5 shows the foil 8 in the unwound condition. The foil 8 is connected to a disc 9 which bears against the underside of the active charge 2.

The disc 9 comprises a pressed fibre material and has a central opening 10. The diameter d1 of the opening 10 is  $\geq$  the diameter d (see Figure 1 and Figure 4).

The described fog projectile can be inserted into a metallic projector barrel 11 (see Figure 6). Figure 6 shows the arrangement in the pulled-apart condition. Arranged at the bottom 12 of the barrel 11 is an electrical firing element 13 whose electrical contacts 14 can be closed by way of a suitable switching device in the vehicle. The firing element 13 upon initiation fires the firing charge 3 which can act at the same time as the ejection charge.

When firing takes place the hollow-cylinder segments 6 are fired and the fog projectile 1 is ejected. In the region of between about 5 and 10 m after the beginning of gas development of ejection, the hollow-cylinder segments 6 remain held together by the foil 8. After the foil 8 burns away,

about 5 to 10 m after leaving the vehicle-mounted barrel 11, the active charge stack 2 fans out, with the hollow-cylinder segments 6 separating, and the individual hollow-cylinder segments 6, after a distance  $S$  at a spacing from the vehicle  $F$  to be protected, develop a fog curtain  $N$  which screens the vehicle  $F$  both in relation to a missile  $K1$  which is threatening in a condition of gliding flight and a missile  $K2$  which is attacking in horizontal flight (see Figure 7).

Development of the protective fog  $N$  is effected for example within 0.25s after the vehicle  $F$  has identified and evaluated the threat posed by the missiles  $K1$  and  $K2$ .

Figure 8 shows a comparison of known operative times and the operative time which can be achieved by the projectile according to the invention. At the time  $t_0$  the vehicle  $F$  identifies the threat posed by an approaching missile and thus triggers discharge of the camouflage fog device, which then takes place at the moment  $t_1$ . The time  $t_4$  is the time at which, according to the calculation of the vehicle  $F$ , the threatening projectile impacts.

In accordance with the state of the art fog generation  $W$  which counteracts the missile threat is achieved in accordance with the line  $a$  at the moment  $t_3$  whereas the active level achieved with the described device is already achieved in accordance with the line  $b$  at the time  $t_2$ . It will be seen in this respect that the period of time between  $t_3$  and  $t_4$  is substantially shorter than the period of the time between  $t_2$  and  $t_4$ . This means that, between  $t_2$  and  $t_4$ , the vehicle under threat has available a substantially longer period of time for travel manoeuvres to evade the threat, than in the state of the art in which only the time between  $t_3$  and  $t_4$  is available for evasive travel manoeuvres.